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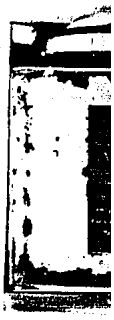

USE OF ISOPERLON, NEW ISULATING MATERIAL, IN GDR ELECTRICAL INDUSTRY

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The Five-Year Plan law urges scientists and technicians to make every effort to reduce the consumption of nonferrous metals, particularly copper, by developing substitute materials. After a year of research work and several years of experimental tests, a group of scientists and technicians from the Hettstedt Nonferrous Metals Rolling Mill and the "Walter Ulbricht" Leunawerke succeeded in producing a new type of insulating material on a Perlon basis. This material, called Iso(lier)perlong (insulating Perlon), exhibits surprising mechanical, electrical, and chemical properties. By using this material, the electrical industry can substitute aluminum for copper, which is both expensive and scarce.

Isoperlon is a combination of superpolyamides and resins which is applied, in solution, to the electrical conductor in several layers and is then baked on. Perlon (polymerized caprolactam in scientific terminology) is produced exclusively from domestic raw materials at the Leunawerke; the material is produced from phenol contained in black-coal tar. The polyamide aminocaprolactam is produced by hydrogenation and conversion, with cyclohexanol-cyclohexanonoxim as an intermediate stage. The extremely thin layers of Isoperlon on wire, strips, and thin sheets of all types of metal are pliable and shock-resistant, and can be cold-worked. Isoperlon is highly elastic and can therefore be processed without adverse effects. It does not dissolve in oil, benzol, gasoline, acetone, or carbon tetrachloride. It is stable while in storage and does not become brittle. An especially prominent characteristic of the material is its mechanical resistance. For example, twisted wires insulated with Isoperlon can be flattened to half their diameter without damaging the material and without greatly impairing the insulating properties.

Because of its superior properties, Isoperlon can be used to insulate wires for electrical machinery and equipment. Up to now, wire coils had to be insulated with cotton material. Today, the construction of electrical machinery is being converted to wire insulated with Isoperlon. In the production of small motors, substantial savings can be made in cotton, copper, and electric power; the use of this insulating material will also improve the cooling and efficiency of small motors.

For example, it will be possible to accomplish an annual savings in the GDR of about 100 tons of cotton valued at 800,000 Deutsche marks. About 145,000 work shirts can be made from this quantity of cotton.

Even more significant is the fact that the use of Isoperlon will make it possible to substitute aluminum for copper. Insulating lacquers formerly used on aluminum wire became brittle and cracked because the thin layer of aluminum oxide which formed on the surface of the wire caused the resin in the insulating material to oxidize. Such poor results were obtained in constructing aluminum motors with lacquered wires that the problem was never approached again. During World War II, aluminum motors insulated with cotton and asbestos were constructed; however, these motors were rather large and awkward and were not as efficient as copper motors; moreover, the thickness of the insulation caused the motors to become overheated.

The relative sizes of a copper conductor insulated with cotton and an aluminum wire with the same conductivity can be illustrated as follows: The cross-section area of the aluminum wire must be 17 percent larger than that of the copper wire, because the conductivity of the aluminum wire is only 35, while the conductivity of the copper wire is 57; e.g., an aluminum wire which is to have

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the same conductivity as a copper wire 1.5 millimeters in diameter will have a diameter of 1.95 millimeters. With two layers of cotton insulation, the copper wire would have an over-all diameter of 1.72 millimeters; thus, the insulating material would add 0.22 millimeter to the diameter. Since the Isoperlon insulation on the aluminum wire will add only .05 millimeter to the diameter, the over-all diameter of this wire would be only 2 millimeters. In the wiring of coils and electric motors, this slight increase in the size of the conductor can be compensated for by improvements in design, so that the size of the motor does not increase. This has the unusual advantage that every motor which is in need of repair can be rewired with aluminum-Isoperlon wire without loss of capacity.

Because of the better heat transmission of the aluminum-Isoperlon wire and the increased heat resistance of the Isoperlon, temperatures between 35 degrees /below zero?/ and 80 degrees /above zero?/ centigrade are permissible without taking any special measures; hence, additional improvements can be made in the design of the motors.

The largest type of motor constructed with aluminum-Isoperlon wire is a 250-kilowatt motor built by the Wernigerode Electric Motor Plant. The material was subjected to experimental tests under unusual conditions (intense heat, cold, and dampness), and the results were astonishing. At Wernigerode, ten motors were put through an endurance test lasting several weeks; the motors were operated at full capacity in a room where the humidity was 90-95 percent and the temperature was 45 degrees centigrade. After a 12-week test run, the test has to be terminated because the moisture-producing installation broke down; the motors, however, were still intact. Careful test proved that the insulating material could withstand temperatures as low as 50 degrees below zero centigrade.

At first, difficulties were encountered in welding the connections of the aluminum-Isoperlon wire. However, most plants have since developed their electric and autogenous welding techniques to such an extent that these difficulties have been almost completely overcome. Hundreds of GDR plants in various industrial fields are now processing this material. The fact that radio sets, electrical household equipment, electric clocks, toys, bicycle lights, solenoids, automobile signal lights, hand drills, etc. can now be bought can be attributed to the discovery of Isoperlon.

The savings which result from the introduction of Isoperlon and from the conversion of aluminum wire amount to about 80 million Deutsche marks yearly. In the past, the capacity of the electrical industry in the GDR could not be fully utilized because of the copper shortage. The use of Isoperlon now makes it possible to utilize fully the capacity of the plants and to export motors and electrical installations.

Aside from the material savings, the conversion from copper to aluminum will be advantageous in other ways to both industry and agriculture. For example, in a machine tractor station an electric motor is a costly piece of equipment, and in the past many small agricultural and handicraft projects could not be carried out because motors, switching equipment, and wire could not be procured.

The discovery of Isoperlon makes available to the economy of the GDR more copper than could be produced by the construction of several new shaft installations and eliminates the necessity of using copper in the electrical industry.

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